

## CLAIMS

### What is claimed is:

1. A fabrication method of VCSEL, used to form a contact electrode on a surface-emitting laser structure in a resonance cavity, comprising forming a heavily doped layer adjacent to a Bragg reflector in the resonance cavity, wherein the heavily doped layer is located in the resonance cavity where the light intensity is the weakest, the process being characterized in that: the Bragg reflector is etched, the distance between the etching stop point and a surface of the heavily doped carrier layer being smaller than a predetermined diffusion depth of dopants to be injected subsequently; and the dopants being doped and diffusing into a predetermined region of a conductive electrode to form a high-carrier-concentration ohmic contact channel connecting to the heavily doped layer, thereby the conductive electrode being formed on the predetermined region, and the electrical property of the dopants is the same as the heavily doped layer.
2. The fabrication method of claim 1, wherein the dopants are zinc elements.
3. The fabrication method of claim 1, wherein the dopants of the heavily doped layer are selected from the group consisting of zinc, carbon, beryllium and magnesium.
4. The fabrication method of claim 3, wherein the dopants of the high-carrier-concentration ohmic contact channel are selected from the group consisting of zinc, beryllium and magnesium.
5. The fabrication method of claim 1, wherein the dopants of the heavily doped layer are silicon.
6. A VCSEL, formed on a substrate, comprising:  
  
a resonance cavity, including an active region, a top heavily doped layer and a bottom heavily doped layer, wherein the active region is excited to generate lights, and the top heavily doped layer and the bottom heavily doped layer are respectively formed on a top

and a bottom of the resonance cavity where the light intensity is the weakest, the electrical property of the carriers of the top heavily doped layer and the bottom heavily doped layer being opposite to each other;

5 a top Bragg reflector and a bottom Bragg reflector, respectively made of semiconductor materials of different refractive index so that light resonates between the top Bragg reflector and the bottom Bragg reflector exciting from the active region;

10 an upper electrode, formed over the top heavily doped layer and adjacent to the top Bragg reflector, wherein the upper electrode connects to the top heavily doped layer via a top high-carrier-concentration ohmic contact channel formed on the top heavily doped layer, the electrical property of the dopants of the top high-carrier-concentration ohmic contact channel being the same as that of the top heavily doped layer, and the depth of the top high-carrier-concentration ohmic contact channel is smaller than the diffusion depth of the dopants in the top high-carrier-concentration ohmic contact channel; and

15 a lower electrode, formed on the bottom heavily doped layer and adjacent to a side of the bottom Bragg reflector connecting to the bottom heavily doped layer.

7. The VCSEL of claim 6, wherein the dopants of the top high-carrier-concentration ohmic contact channel are zinc.

8. The VCSEL of claim 6, wherein the dopants of the top heavily doped layer are selected from the group consisting of zinc, carbon, beryllium and magnesium.

20 9. The VCSEL of claim 8, wherein the dopants of the top high-carrier-concentration ohmic contact channel are selected from the group consisting of zinc, beryllium and magnesium.

10. The VCSEL of claim 6, wherein the dopants of the bottom heavily doped layer are silicon.

25 11. The VCSEL of claim 6, further comprising a bottom high-carrier-concentration

ohmic contact channel via which the lower electrode connects to the bottom heavily doped layer.

12. A fabrication method of VCSEL, implemented to form a contact electrode on a substrate in a resonance cavity, comprising:

5 subsequently forming a bottom Bragg reflector, a resonance cavity and a top Bragg reflector, wherein the resonance cavity includes a bottom heavily doped layer and a top heavily doped layer, wherein the bottom heavily doped layer has a carrier electrical property opposite to that of the top heavily doped layer;

10 etching the Bragg reflector, wherein the distance between the etching stop point and the top heavily doped layer is smaller than a dopant diffusion depth of a subsequently formed top high-carrier-concentration ohmic contact channel;

diffusing dopants into an upper electrode predetermined region to form a top high-carrier-concentration ohmic contact channel connecting the top heavily doped layer, wherein the dopant electrical property of the top high-carrier-concentration ohmic contact  
15 channel is opposite to that of the top heavily doped layer; and

forming the upper electrode at the predetermined region, wherein the top high-carrier-concentration ohmic contact channel connects to the top heavily doped layer via the upper electrode.

20 13. The fabrication method of claim 12, wherein the dopants in the diffusing step are zinc.

14. The fabrication method of claim 12, wherein the dopants of the top heavily doped layer are selected from the group consisting of zinc, carbon, beryllium and magnesium.

15. The fabrication method of claim 14, wherein the dopants are selected from the group consisting of zinc, beryllium and magnesium.

16. The fabrication method of claim 12, wherein the dopants of the heavily doped layer are silicon.

17. The fabrication method of claim 12, further comprising a bottom high-carrier-concentration ohmic contact channel via which the lower electrode connects to  
5 the bottom heavily doped layer.